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LYMAN J. BRIGGS RETIRES, SUCCEDED BY E. U. CONDON

Dr. LYMAN J. BRIGGS, Director of the Bureau for the past twelve years, retired on November 5 after a continuous service of over 49 years in the technical work of the Government. Born May 7, 1874, on a farm north of Battle Creek, Mich., he spent his boyhood in this vicinity. He never attended high school, but was able to enter Michigan State College by examination at the age of fifteen, graduating second in his class four years later. The following two years were spent at the University of Michigan, where he received the degree of Master of Science in physics. The next fall he entered Johns Hopkins University in Baltimore to continue his studies under the renowned Professor Rowland. This was the year that Roentgen announced the discovery of X-rays, and Briggs carried out the first X-ray studies at Johns Hopkins.

In June 1896 Dr. Briggs entered the Department of Agriculture as a physicist in its Bureau of Soils, and in 1900 the Secretary of Agriculture, Hon. James Wilson, generously arranged for him to complete his work for his doc-

torate at Johns Hopkins, without severing his connection with the Department. During his service with the Bureau of Soils, Dr. Briggs originated the centrifugal method of classifying soils, based upon the percentage of water a soil can hold against a force 1,000 times that of gravity. This determination, known as the moisture equivalent, is now widely used in soil laboratories throughout the world.

In 1906 Dr. Briggs was invited to organize the biophysical laboratory in the Bureau of Plant Industry. Here he began his basic studies of the influence of environmental factors on the water requirements of plants, in collaboration with the ecologist, Dr. H. L. Shantz, and during the next 10 years the names of Briggs and Shantz appeared on many monographs in this field. In the course of this work, methods were developed for determining the "wilting coefficient" of a soil, which has found wide application in establishing the amount of water in a soil that is available for plant growth.

On the entry of the United States into the first World War (1917), Dr. Briggs was detailed by Executive order to the Bureau of Standards for special

¹ Published with approval of the Director of the Budget.

work on a stable zenith instrument for the Navy. In 1920 he became a member of the Bureau's staff and chief of the Mechanics and Sound Division. Here he was associated with Dr. Paul R. Heyl, and together they invented the earth inductor compass, for which they received the Magellan Medal in 1922. In 1926 Dr. Briggs was appointed Assistant Director for Research and Testing, under Dr. George K. Burgess. On the sudden death of the latter in July 1932, Dr. Briggs was selected for the vacancy by President Hoover, but the appointment, along with others, was not confirmed. When Mr. Roosevelt became President he immediately resubmitted Dr. Briggs' name, which was approved by the Senate. He thus has the distinction of having received his appointments from two Presidents.

At the time Dr. Briggs became Director, the country was in the depths of the depression, from which the Bureau suffered, along with other organizations and individuals. Reduced appropriations made necessary a severe curtailment in the staff and in the work that could be carried on, particularly in basic research. Dr. Briggs handled this difficult and discouraging situation with such judgment and fairness that he won the respect of every Bureau employee. On June 30, 1934, the staff numbered 668, the lowest in many years. As business conditions improved, many of those who had been laid off were reinstated and new appointments were made, but even on June 30, 1940, the staff was smaller than it had been 8 years before.

Under pressure of preparedness and war, the number of Bureau employees was rapidly increased, until on June 30, 1944, the total was 2,279. The usual difficulties of recruitment were aggravated by the war, including not only the demands for men by the armed services, but the competition of private industry and of newly created agencies within the Government with their higher pay scales and more rapid advancement. As military problems were submitted in increasing volume, the Bureau was placed on a war footing, its grounds became a prohibited zone, and by 1942 the Director estimated that 90 percent of the personnel and equipment were engaged in war work. As a scientific laboratory, the Bureau had always been a place where the greatest freedom of thought and of discussion prevailed. For security reasons, this had to be changed, almost over night. That this was accomplished without significant loss of esprit de

corps is due largely to the good sense and example of the Director.

Although Dr. Briggs' record as an administrator is an enviable one, he considers himself to be, first of all, a physicist and is never so happy as when in the laboratory. Perhaps it was for this reason that he was selected by the President in 1939 as chairman of the original Uranium Committee to study the possibility of using atomic energy in warfare. His connection with this project was unknown to most of the Bureau's staff, yet he was closely identified with all the earlier work and personally directed much of the research.

Dr. Briggs has been a member of the National Advisory Committee for Aeronautics since 1933 and was elected vice chairman in 1942. He has been a member of the aerodynamics subcommittee for 23 years, and during the time that he headed the Bureau's Mechanics and Sound Division, he gave particular attention to its researches in air flow. With Dr. Hugh L. Dryden he made pioneer measurements of flow around airfoils at very high speeds up to and exceeding the speed of sound. The results of this work found application in determining the blade form of aircraft propellers. He has always enjoyed a difficult problem in the design of apparatus and was selected to head the instrument work in connection with the two stratosphere balloon flights sponsored by the National Geographic Society and the Army Air Service. Typical examples at the Bureau are his machines for floating metallic fatigue specimens on a layer of compressed air, and for measuring the forces on an elastic ball when struck. His interest in the theoretical side of his work is equally keen. He accepted the sponsorship of the "Project for the Computation of Mathematical Tables" (Work Projects Administration for the city of New York) in 1938. In all, 57 tables have thus far been made available to the public; the project is being continued with the support of the Office of Research and Inventions of the Navy Department.

Dr. Briggs became chairman of the Federal Specifications Board in 1932, of the Federal Fire Council in 1933, and of the National Conference on Weights and Measures in 1935. He is a life trustee of the National Geographic Society and has served as chairman of its Research Committee. He is a director of the American Standards Association, and a member of the American Physical Society, Washington Academy of Sciences, Philosophical Society of Wash-

ington, American Philosophical Society, Tau Beta Pi, and Sigma Xi. He is a member and past president of the Cosmos Club and of the Federal Club. He was elected a member of the National Academy of Sciences in 1942. In 1932, his alma mater, Michigan State College, conferred on him the honorary degree of Doctor of Science, to be followed by an LL.D. from the University of Michigan in 1936. He has been honored by degrees of Doctor of Engineering from the South Dakota School of Mines in 1935, and Doctor of Science from George Washington, Georgetown, and Columbia Universities.

Dr. Briggs was married to Katharine E. Cook of Claremont, California, in 1896. They had two children, Albert Cook, who died in 1901, and Isabel (now Mrs. C. G. Myers). A grandson, Peter Myers, is serving in the United States Naval Reserve.

The facilities of the Bureau's laboratories have been offered to Dr. Briggs as "Director Emeritus of the National Bureau of Standards" by Secretary Wallace. His associates hope that he may be willing to resume some of the research that he was obliged to drop when he became Director.

Dr. E. U. Condon, who succeeds Dr. Briggs, was born March 2, 1902, in Alamogordo, New Mexico. He was graduated from the University of California in 1924, and received his doctor's degree from that institution in 1926. During 1926-27 he was a National Research Fellow at Göttingen and Munich, and was a physics lecturer at Columbia University in 1928. He served as assistant professor of physics at Princeton during 1928-29 and as associate professor from 1930 till 1937. During 1929-30 he was professor of theoretical physics at the University of Minnesota, and since 1937, advisory professor at the University of Pittsburgh. He became associate director of Westinghouse Research Laboratories in 1937, a position which he occupied until his appointment by President Truman to the directorship of the Bureau.

Dr. Condon served with Dr. Briggs on the original Uranium Committee and had charge of many top secret projects during the war. He is an internationally recognized authority in the new field of electronics and is coauthor of treatises on quantum mechanics and theory of atomic spectra. He is a member of the National Academy of Sciences, and is now serving as scientific adviser to the special committee on atomic energy of the United States Senate.

INTERSERVICE RADIO PROPAGATION LABORATORY

The important part played by the Bureau during the war in predicting radio transmission conditions between any two places on the earth's surface, has just now become known to the public through the release of this work from a "classified" status.

Early in the war, a group of experts, working under the general supervision of J. H. Dellinger and Newbern Smith, were organized as the United States centralizing group for ionospheric and radio propagation data taken all over the world. They were designated as the IRPL (Interservice Radio Propagation Laboratory) and served under the Wave Propagation Committee of the Joint Communications Board, which, in turn, came under the U. S. Joint Chiefs of Staff.

The primary function of the IRPL was to furnish radio propagation information and predictions to the Allied Military Services and to advise them on radio communication problems of operational importance. This information was particularly needed because of the widespread use of radio in the far corners of the world, the necessity for efficient utilization of frequencies in the crowded radio spectrum, and the importance of knowing just where radio waves were going and how to insure their arriving at their destination. To this end the laboratory prepared monthly world-wide charts of predicted ionospheric data, from which usable frequencies for any path could be calculated; distributed all available ionospheric and radio propagation data to the armed services, commercial users, and scientific laboratories; sent out warnings of expected radio disturbances associated with "storms" in the ionosphere; carried on research in radio wave propagation and in the techniques of prediction; developed methods for solving high-frequency radio propagation problems; studied radio wave absorption in the ionosphere; analyzed radio traffic data from the propagation viewpoint; correlated high-frequency direction-finder errors with ionosphere conditions; and, as an essential part of the entire program, operated the Bureau's field station at Sterling, Va., where observations were made and new apparatus developed. A considerable part of this work is being continued because it has important peacetime applications.

One of the important jobs was the training of military radio men in the

operational use, both tactical and strategic, of radio propagation data and predictions. This was particularly needed because of the hitherto limited knowledge and application of the information, since there were, at the beginning of the war, a very few men who had had any background or training in this field. In this connection, the laboratory issued the "IRPL Radio Propagation Handbook," which gave the essential facts of radio propagation and rapid practical methods for solution of radio propagation problems.

Probably the most valuable information made available by the group appears in its IRPL-D series of monthly reports, entitled "Basic Radio Propagation Predictions for (date)—Three Months in Advance." Thus IRPL-D15, issued on November 1, gave the predictions for February 1946. Another regular monthly report constitutes the IRPL-F series, "Ionospheric Data." These give graphs and tabulations of vertical-incidence ionosphere characteristics for all the ionosphere stations in the world from which data are obtainable. Other reports, giving the results of research developments, are issued in an IRPL-R series. A recent one, IRPL-R23, is an "unclassified" (no restrictions on distribution) report, entitled "Solar Cycle Data for Correlation with Radio Propagation Phenomena."

Associated directly with the IRPL are laboratories at Stanford University, California; Louisiana State University, Baton Rouge, La.; University of Puerto Rico, San Juan, P. R.; Harvard University, and Massachusetts Institute of Technology, both at Cambridge, Mass. Valuable help has been received from the Carnegie Institution of Washington, Department of Terrestrial Magnetism, which maintained observatories at the University of Alaska and other places, and also centralized solar and magnetic data. Ionospheric and radio propagation data are centralized by the National Bureau of Standards from about 50 stations operated by the United States, Great Britain, Canada, Australia, New Zealand, and the U. S. S. R. These world-wide sources of information are listed each month in the IRPL-F series of reports.

HIGH DIELECTRIC CONSTANT CERAMIC COMPOSITIONS

Compactness in radio equipment is desirable where easy portability is of major importance, as in walkie-talkie sets and airplane use. During the past few years a type of condenser for use

in such apparatus has been developed, using titania and titanates as the dielectric material in place of the usual paper or mica. As the ability of these titania compounds to hold electricity may be several hundred times that of mica or paper, a condenser made with the titanates can replace a much larger condenser made with mica or paper. Because titania specimens lack the flexibility of mica or paper and are more easily punctured by high voltages, the full advantage of the titania compositions is not attainable in practical applications.

A systematic investigation of the dielectric constant and power loss in the various titanate specimens has been under way for the past year by E. N. Bunting, G. R. Shelton, and A. S. Creamer. Studies have been made of compositions in the system BaO-SrO-TiO₂. After heating to 1,450° C, titanate specimens containing more BaO or SrO than the composition lying on the SrO:TiO₂-BaO:TiO₂ join have a tendency to disintegrate slowly, probably because of the presence of free oxides reacting with moisture in the air. The highest dielectric constants of 10,000 or more are found for compositions lying on this join. Unfortunately, these high values occur only over a very small temperature range and fall to approximately one-fifth the peak value of the dielectric constant at temperatures about 20 degrees centigrade from the temperature at which the peak occurs. The highest dielectric constant, *K*, occurs at 118° C for BaO:TiO₂. This temperature is lowered as SrO:TiO₂ is added, and for the composition 71 percent of BaO:TiO₂, 29 per cent of SrO:TiO₂ the peak *K* is near room temperature. By extrapolation it appears that the top *K* for SrO:TiO₂ is in the neighborhood of -250° C. The power loss, in general, decreases as SrO:TiO₂ is added to BaO:TiO₂, with SrO:TiO₂ having about 1 percent of that of BaO:TiO₂.

For compositions near the SrO:TiO₂-BaO:TiO₂ join, the peak *K* decreases as the content of TiO₂ increases. For all compositions investigated, the peak *K* becomes lower as the SrO content increases. A minimum value of *K* (35) measured at 25° C and a frequency of 1 megacycle per second, occurs in the neighborhood of the preparation having the composition BaO:4TiO₂, indicating the existence of a compound in this region. No minimum value of *K* has been found in the binary system SrO:TiO₂-TiO₂.

The dielectric constant for these titanate compositions depends somewhat upon the heat treatment. For mature specimens with absorptions under 0.1 percent, the value of K varies from 35 for $\text{BaO} : 4\text{TiO}_2$ to 98 for TiO_2 , to 270 for $\text{SrO} : \text{TiO}_2$, and to about 1,400 for $\text{BaO} : \text{TiO}_2$, all measured at 1 megacycle per second and 25° C. The power loss varies greatly with frequency, and is highest for mature specimens having compositions in the neighborhood of $2\text{BaO} : 3\text{TiO}_2$ ($Q=40$) and lowest ($Q=5,000$ to 10,000) for compositions of high TiO_2 or SrO content.

DISSOCIATION CONSTANTS CALCULATED FROM ULTRAVIOLET SPECTRA

Most organic compounds that are colorless in the visible region of the spectrum, have absorption bands in the ultraviolet. Spectrophotometric measurements in the ultraviolet range have now been obtained with such accuracy that the dissociation constants of weak electrolytes can be calculated. In the December number of the Journal of Research (RP1686), Elizabeth E. Sager, Marjorie R. Schooley, Alice S. Carr, and S. F. Acree report results on solutions of *p*-hydroxybenzoic acid, several of its esters, and potassium *p*-phenolsulfonate at 25° C by this method.

The absorption bands of the ionic and molecular forms of each compound were first obtained, with the use of acid, alkali, or buffers of widely different pH values. Several intermediate steps in the transformation of one form into the other were then measured. The pH of each solution was controlled by buffers of low ionic strengths, of known pH values, at each step in the transformation. From the spectral transmittances at one or several wavelengths, the amounts of the molecular and ionic forms can be calculated. When the pH of the buffered solution is known, the apparent dissociation constant, or pK^* , can then be determined.

The pK^* values of methyl, ethyl, *n*-butyl, and benzyl *p*-hydroxybenzoate are all approximately 8.3. The pK^* values for the first and second steps in the dissociation of *p*-hydroxybenzoic acid were found to be 4.5 and 9.3. The estimated value of pK_a , the negative logarithm of the thermodynamic dissociation constant, for potassium *p*-phenolsulfonate is 9.03. This value is 0.02 of a unit lower than the value found by emf studies.

FIRST DISSOCIATION CONSTANT OF *o*-PHTHALIC ACID

As pointed out in Technical News Bulletin 343 (November 1945), the measurement and control of acidity or alkalinity (pH) is often important in industrial processes involving solutions. It has long been recognized that one of the most useful standards for the determination and control of pH in the region of 2.5 to 3.5 is a mixture of *o*-phthalic acid and acid potassium phthalate. In the Journal of Research for December (RP 1687), W. J. Hamer, G. D. Pinching, and S. F. Acree report measurements of the electromotive forces of galvanic cells comprised of hydrogen and silver-silver-chloride electrodes with 45 different solutions of *o*-phthalic acid, acid potassium phthalate, and potassium chloride, at 5-degree intervals from 0° to 60° C.

Pure materials, including the NBS Standard Sample 84a of acid potassium phthalate were used. From the values of the electromotive force, the first dissociation constant of *o*-phthalic acid and related thermodynamic quantities were evaluated, and pH values assigned to the 45 different solutions. The pH values of the solutions range from 2.70 to 3.26, and are known with a precision of 0.003 pH unit. They differ on the average by only 0.07 pH unit between 0° and 60° C. Their usefulness as pH standards is therefore enhanced by the low temperature coefficient. The values are higher by approximately 0.04 pH unit than ones previously assigned to solutions of this composition. This may be explained by the present use of hydrogen-ion activity, rather than hydrogen-ion concentration, as the basis of the pH scale and by the elimination of liquid-junction errors, a source of uncertainty in previous values.

Thermodynamic constants are also given for the dissociation of the *o*-phthalic acid into hydrogen and acid phthalate ions and are compared with similar data for the dissociation of other acid molecules. The value for the change in heat capacity for the dissociation is about one-half that found for other dissociations. The low value is explained by the presence of chelation and inductive effects in *o*-phthalic acid. The separation of the carboxyl groups in *o*-phthalic acid was also calculated at each temperature from a relation between this distance and the ratio of the two dissociation constants. It was found that the value is practically in-

dependent of the temperature and is about 1.66 Å. This value is higher than 1.53 Å for the carbon-carbon distance in the diamond and 1.43 Å for the carbon-carbon distance in benzene, but is of the expected order of magnitude.

REACTION OF PERIODIC ACID ON THE DIFRUCTOSE ANHYDRIDES

As set forth in a report by Emma J. McDonald and the late Richard F. Jackson in the December Journal of Research (RP1683), the difructose anhydrides have been reacted with periodic acid. In keeping with their known structures, difructose anhydrides III and I react, respectively, with one and two moles of acid. Difructose anhydride II reacts with one mole of periodic acid; thus it contains only two adjacent carbons carrying free hydroxyl groups. From this fact, along with previously determined data, it is suggested that 1,2'-2,4'-difructofuranose is the most probable structure for difructose anhydride II.

THERMODYNAMIC PROPERTIES OF SOLID AND LIQUID ETHYL-BENZENE

Synthetic rubber production in the United States has increased vastly since this country was cut off from its natural rubber supplies. Because of the urgency of the situation when the synthetic rubber program was initiated, the materials needed were put into quantity production in the shortest possible time; there was no chance for the usual experimentation and proving of processes. Thus far, the synthetic rubber known as GR-S or Buna S, has proved to have the greatest all around utility and has been produced in the largest quantities.

Buna S is a copolymer of 1,3-butadiene and styrene. Styrene for synthetic rubber is made from ethylbenzene. It is to be expected that a better knowledge of the thermodynamic properties of ethylbenzene will result in a saving of critical materials.

In a paper by R. B. Scott and F. G. Brickwedde published in the December number of the Journal of Research (RP1684), the specific heats of solid and of liquid ethylbenzene were measured from 15° to 300° K. The triple point was found to be -95.005° C., the heat of fusion, 86.47 int. $j\ g^{-1}$, and the heat of vaporization, 400.15 int. $j\ g^{-1}$ at 294° K. Measurements of the vapor pressure of ethylbenzene were made from 273° to 296° K.

THERMODYNAMIC PROPERTIES OF ACETYLENE HYDROCARBONS

The December number of the Journal of Research contains a report (RP1682) entitled, "Heats, Equilibrium Constants, and Free Energies of Formation of the Acetylene Hydrocarbons through the Pentynes, to 1,500° K" by Donald D. Wagman, John E. Kilpatrick, Kenneth S. Pitzer, and Frederick D. Rossini. The report, prepared as part of the work of the American Petroleum Institute Research Project 44 and the Bureau's thermochemical laboratory, presents values for the following thermodynamic properties, for acetylene, propyne (methylacetylene), 1-butyne (ethylacetylene), 2-butyne (dimethylacetylene), 1-pentyne (*n*-propylacetylene), 2-pentyne (methylethylacetylene), and 3-methyl-1-butyne (isopropylacetylene), in the gaseous state, to 1,500° K; the heat content function, $(H^\circ - H^\circ_0)/T$; the free-energy function, $(F^\circ - F^\circ_0)/T$; the entropy, S° ; the heat content, $(H^\circ - H^\circ_0)$; the heat capacity, C_p° ; the heat of formation from the elements, ΔH_f° ; the free energy of formation from the elements, ΔF_f° ; and the logarithm of the equilibrium constant of formation from the elements, $\log_e K_f$.

Equilibrium constants and concentrations of components are given in tabular and graphical form for the isomerization of the two butynes and of the three pentynes as a function of temperature to 1,500° K. Equilibrium constants are also given in tabular and graphical form for the dehydrogenation of ethane to ethylene to acetylene, of propane to propylene to propyne, of *n*-butane to 1-butene to 1-butyne, and of *n*-pentane to 1-pentene to 1-pentyne.

DENSITY BALANCE FOR LIQUID HYDROCARBONS

Research Paper RP1685 in the December number of the Journal of Research deals with the assembly and calibration of a density balance for liquid hydrocarbons. This is a development by Alphonse F. Forzlati, Beverage J. Mair, and Frederick D. Rossini, of the American Petroleum Institute Research Project 6 in the Bureau's Section on Thermochemistry and Hydrocarbons. With this apparatus, samples as small as 9 ml in volume may be measured with a reproducibility of ± 0.00003 g/ml and an estimated over-all uncertainty of ± 0.00005 g/ml.

ENGINE TESTS OF NON-PETROLEUM FUELS

The performance of typical automobile engines when operating on nonpetroleum fuels has been determined by Jesse T. Duck and C. S. Bruce as part of an extensive study of substitute motor fuels, requested by the Foreign Economic Administration (Technical News Bulletin 342, October 1945). These included ethyl alcohol, acetone, butanol, gasoline, and four blended fuels. Tests were made on four automobile engines (two 1942 Plymouths, a 1942 Chevrolet, and a 1940 Ford V-8) direct-connected to electric dynamometers. Full-throttle tests at 1,500 rpm were made on all the engines, using a number of fuels with varying air-fuel ratios. Road load tests were made on one of the 1942 Plymouth engines at engine speeds equivalent to road operation at 20, 30, 40, and 50 miles per hour. Other tests were made on this engine with various low-proof alcohols as fuels, the engine being operated at 1,500 rpm, full throttle, with varying air-fuel ratios.

In studies of mixture distribution, a special type spark plug was used. This had an iron-constantan thermocouple inserted in a tubular center electrode and spot-welded to the electrode near its tip. The spark plug was devised by Rabezzana and Kalmar, who found, in tests similar to those reported herein, that the temperature at the top of the electrode was proportional to the mean combustion temperature.

As reported in the Journal of Research for December (RP1681), temperature changes were found to be closely correlated with changes in air-fuel ratios. If it is assumed that the peak temperatures occur under similar conditions in all the cylinders of an engine, the thermocouple temperatures that China will purchase in the United States for use by the government as well as by private concerns and individuals. The Bureau has made a beginning by supplying the Committee with a complete set of the effective Simplified Practice Recommendations. A similar courtesy has been extended to the Ministry of Communications, of the Republic of China.

The conclusion is that automotive engines can be successfully operated on a number of substitute fuels, but that performance can be improved if the fuel system is adapted for distribution of the particular fuel used.

SIMPLIFIED PRACTICE IN CHINA

More than 10 years ago, there was in operation in China a governmental agency concerned with the advancement of simplification and standardization, and which was in close touch with the Bureau's Division of Simplified Practice. Data of mutual interest were exchanged, following the procedure adopted in the case of Great Britain, France, Australia, and New Zealand.

The work of this Chinese organization has been reactivated, in the Ministry of Economic Affairs of the Republic of China, according to the Secretary of the Chinese Standards Committee, who visited the Bureau recently. This official made specific and detailed arrangements with the Division for complete interchange of experience in the field of simplification. The Chinese Standards Committee will furnish English translations of all their standards, and the Bureau will keep the Committee continuously informed regarding manufactured articles and commodities that are simplified by American industries—things that China will purchase in the United States for use by the government as well as by private concerns and individuals. The Bureau has made a beginning by supplying the Committee with a complete set of the effective Simplified Practice Recommendations. A similar courtesy has been extended to the Ministry of Communications, of the Republic of China.

HENRY S. RAWDON RETIRES AS CHIEF OF DIVISION OF METALLURGY

Henry S. Rawdon, chief of the Division of Metallurgy, retired from active duty on October 31, after 33 years service. Born in England, June 7, 1880, he was four years old when his family came to Michigan, where he grew up and went to school, graduating from Michigan State Normal College. After 6 years as a teacher of chemistry and biology, and as superintendent of a Michigan high school, he decided to make a career of science and in 1909 entered the College of Engineering of the University of Michigan. There he became interested in the newly intro-

It was found that the intake manifolds of the engines ran cooler with the substitute fuels than with gasoline. The maximum power with ethyl alcohol and with some of the other fuels was slightly greater than with gasoline. The amount of fuel required was inversely proportional to its heat of combustion. The analysis of the combustion temperature data indicated that the distribution of the substitute fuels used was not as good as that of gasoline.

In operation with low-proof alcohols, excessive amounts of fuel were required. With blends lower than 140-proof, auxiliary jets were necessary, and with some of the lower-proof blends auxiliary fuel pumps had to be installed.

duced subject of metallurgy and, in his senior year, was personal assistant to the blind Prof. Edward De Mille Campbell, one of the outstanding members of the small group of pioneer metallurgists.

On receipt of the degree of B. Ch. E. from the University of Michigan in 1912, Mr. Rawdon had started post-graduate work when, in November of that year, he received an appointment as assistant physicist at the National Bureau of Standards. His first assignment was with the late Dr. George K. Burgess in the section of metallurgy and metallography, then a part of the Division of Thermometry, Pyrometry, and Heat Measurements. In July 1913, the section was reorganized as the Division of Metallurgy with Dr. Burgess as chief, and a staff of five—J. R. Cain, J. J. Crowe, H. S. Rawdon, Howard Scott, and R. G. Waltenberg. Mr. Rawdon has been a member of the Division throughout its entire existence and its Chief since July 1929. He succeeded H. W. Gillett, who had been appointed when Dr. Burgess became Director of the Bureau in 1923.

Metallography, particularly the relation of crystalline structure to the properties and behavior of metals, is still one of Mr. Rawdon's major interests. His early publications dealt with a variety of subjects, both ferrous and nonferrous, and much of this was pioneer work, for example, that on metallographic etchants and technic, his demonstration of the value of metallographic examination of electrically welded steel in the very early days of the welding industry, and, particularly, his investigation of the phenomenon of "flakes" or "shatter cracks" as a cause of failure in gun forgings and railroad rails. Metallographic studies of corroded metals led to an interest in corrosion processes and in protective coatings. His book, "Protective Metallic Coatings," published in 1928 in the series of monographs sponsored by the American Chemical Society, was one of the first in this field. His interest in, and knowledge of, other phases of metallurgy, is evidenced by the titles of his 83 technical publications and by the number and variety of technical and advisory committees on which he has served.

Mr. Rawdon is a member of many years standing of the American Society for Metals, American Institute of Mining and Metallurgical Engineers, and American Society for Testing Materials, and he has served on many of their committees, including the Metals Handbook Committee of the ASM, the Annual Lecture Committee of the Institute of Met-

als Division of the AIMME, and numerous ASTM committees and subcommittees on corrosion, specifications, methods of testing, papers and publications, fatigue of metals, die-cast metals and alloys, metallography, et cetera. He will continue to represent the Bureau's interests on certain important ASTM committees after October 31.

His service on advisory committees includes Government organizations (National Advisory Committee for Aeronautics, War Department, Federal Specification Board), and educational institutions (Pennsylvania State College). During World War II he was active in committees advisory to the Frankford Arsenal of the War Department, Army and Navy Munitions Board, Office of Production Management, War Production Board, and National Academy of Sciences.

Dr. J. G. Thompson has been appointed Acting Chief of the Division of Metallurgy. For the past 15 years he has headed the Section of Chemical Metallurgy.

NEW AND REVISED PUBLICATIONS ISSUED DURING NOVEMBER 1945

Journal of Research *

Journal of Research of the National Bureau of Standards, volume 35, number 3, September 1945 (RP1668 to RP1670, inclusive). Price 30 cents. Annual subscription, 12 issues, \$3.50.

Commercial Standard *

CS127-45. Self-contained mechanically refrigerated drinking-water coolers. Price 10 cents.

Technical News Bulletin *

Technical News Bulletin 343, November 1945. Price 5 cents. Annual subscription, 50 cents.

MIMEOGRAPHED MATERIAL

Letter Circulars

(*Letter Circulars* are prepared to answer specific inquiries addressed to the National Bureau of Standards and are sent only on request to persons having a definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or send copies automatically as issued.)

* Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, \$3.50 per year (to addresses in the United States and its possessions and to countries extending the franking privilege); other countries, 70 cents and \$4.50, respectively.

- LC806. Publications relating to accident prevention and safety. (Supersedes LC60.)
- LC807. Home heating problems: List of publications and articles. (Supersedes LC702.)
- LC809. Color charts: A descriptive list. (Supersedes LC865.)
- LC810. The painting of exterior wood surfaces. (Supersedes LC803.)

**RECENT ARTICLES BY MEMBERS
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